

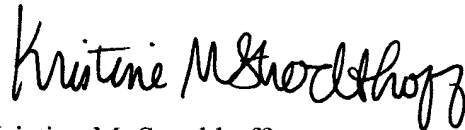
**REMARKS**

Claims 1-50 and 53-146 are pending. Claims 51-52 have been cancelled.  
Claims 116-146 have been added.

Support for the newly added claims is in the original claims as filed, particularly  
Claims 39 and 68, 44-48, and 77-80.

Applicant believes that the claims are in condition for allowance, and notification to that  
effect is respectfully requested.

Respectfully submitted,



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## Replacement Claims

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### WHAT IS CLAIMED IS:

1. A flexible film interposer, comprising:  
a flexible substrate comprising a first surface, a second surface, and opposing sides;  
a plurality of spaced apart recesses having a base and extending through the flexible substrate for receiving conductive connecting members of a first semiconductor die therein;  
a slot formed through the substrate and disposed adjacent one of the sides of the substrate; and  
a plurality of conductive traces disposed on the second surface of the substrate, each trace extending over the slot and at least one recess, each of the recesses having a trace disposed at the base thereof.
2. The flexible film interposer of Claim 1, comprising an insulating polymeric material.
3. The flexible film interposer of Claim 2, comprising a flexible polyimide film.
4. The flexible film interposer of Claim 1, having a thickness in the range of about 12.5  $\mu\text{m}$  to about 200  $\mu\text{m}$ .
5. The flexible film interposer of Claim 1, wherein the traces comprise copper or a copper alloy.
6. The flexible film interposer of Claim 1, wherein the slot is configured to receive a bonding tool therethrough.
7. The flexible film interposer of Claim 1, wherein the slot has a width of about 50  $\mu\text{m}$  to about 2 mm.
8. The flexible film interposer of Claim 1, wherein the slot is shaped as a square, rectangle, circle, or oval.

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9. The flexible film interposer of Claim 1, wherein the recesses comprises tapered side walls.

cony. 10. The flexible film interposer of Claim 1, wherein the recesses comprise vertically oriented sidewalls.

11. The flexible film interposer of Claim 1, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on an active surface of a semiconductor die to be attached thereto.

12. The flexible film interposer of Claim 1, wherein the recesses are shaped as a square, rectangle, circle, or oval.

13. The flexible film interposer of Claim 1, wherein the slot comprises tapered side walls.

14. The flexible film interposer of Claim 1, wherein the slot comprises vertically oriented sidewalls.

15. The flexible film interposer of Claim 1, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces.

16. The flexible film interposer of Claim 15, wherein the adhesive element comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.

17. The flexible film interposer of Claim 15, wherein the adhesive element comprises an adhesive gel or paste.

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18. The flexible film interposer of Claim 15, wherein the adhesive element comprises a double-sided adhesive tape.

19. The flexible film interposer of Claim 15, wherein the adhesive element is disposed on the second surface of the interposer and over a portion of the traces.

20. The flexible film interposer of Claim 1, comprising two discrete areas of recesses with an adhesive element disposed therebetween on the first surface of the interposer.

21. The flexible film interposer of Claim 1, further comprising a soldermask disposed over the traces.

22. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot formed through and adjacent a side of the interposer;  
a plurality of recesses formed through the interposer and adjacent the slot, each recess sized for receiving therein a connecting member of a die in a flip chip attachment onto the interposer; and  
a plurality of conductive traces disposed on the second surface of the interposer, each trace extending over and exposed through the slot and the base of at least one of the recesses, each recess having a trace disposed at the base thereof.

23. The flexible film interposer of Claim 22, wherein the slot is sized to receive a bonding tool therethrough.

24. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot formed through and adjacent a side of the interposer;

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CONT. a plurality of recesses formed through the interposer and adjacent the slot, each recess sized for receiving therein a connecting member of a die in a flip chip attachment onto the interposer; and

a plurality of conductive traces disposed on the second surface of the interposer, each trace extending over and exposed through the slot and one of the recesses.

25. The flexible film interposer of Claim 24, wherein an adhesive element is disposed on the first surface, the second surface, or both surfaces of the interposer.

26. The flexible film interposer of Claim 25, wherein an adhesive element is disposed on the second surface of the interposer over a portion of the traces.

27. A flexible film interposer, comprising:

a first surface and a second surface; and

an elongate slot formed through the interposer, the slot positioned along a peripheral edge of the interposer to expose bond pads on a die mounted onto the second surface of the interposer;

a plurality of recesses formed through the interposer and adjacent the slot, each recess having a base and sized for receiving therein a connecting member of a die mounted in a flip chip attachment onto the first surface of the interposer; and

a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot.

28. The flexible film interposer of Claim 27, wherein the slot is sized and configured to receive a bonding tool therethrough to contact the traces.

29. The flexible film interposer of Claim 27, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on an active surface of a semiconductor die to be attached thereto in a flip chip attachment.

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30. The flexible film interposing of Claim 27, further comprising a soldermask disposed over the traces.

31. The flexible film interposer of Claim 30, further comprising an adhesive element disposed over the soldermask.

32. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot along a peripheral edge of the interposer;  
a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and  
a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each of the recesses having a trace disposed at the base thereof.

33. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot along a peripheral edge of the interposer;  
a plurality of spaced apart recesses formed through the interposer adjacent to the slot, each recess having a base;  
a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess; and  
an adhesive element disposed on the first surface, the second surface, or both surfaces of the interposer.

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34. The flexible film interposer of Claim 33, wherein an adhesive element is disposed on the second surface of the interposer and over a portion of the traces.

35. The flexible film interposer of Claim 33, further comprising a soldermask disposed over the traces.

36. The flexible film interposer of Claim 35, further comprising an adhesive element disposed over the soldermask.

37. A flexible film interposer, comprising:

a flexible substrate comprising a first surface, a second surface, and opposing sides;

the first surface of the substrate structured for mounting thereon a first semiconductor die having a plurality of spaced apart conductive connecting members disposed on an active surface, and the second surface structured for mounting thereon a second semiconductor die having a plurality of bond pads spaced along a periphery of the die;

the first surface of the substrate comprising a plurality of spaced apart recesses having a base and extending through the substrate for receiving the plurality of conductive connecting members of the first semiconductor die therein; and

the second surface of the substrate comprising one or more slots extending through and along a periphery of the substrate, wherein when the second semiconductor die is mounted thereon, the bonding pads are exposed through the slots.

38. The flexible film interposer of Claim 37, further comprising:

a plurality of conductive traces disposed on the second surface of the substrate, each trace extending over the slot and at least one recess, each of the recesses having a trace disposed at the base thereof.

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39. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die when mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of at least one recess in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

40. The semiconductor device of Claim 39, wherein the flexible film interposer comprises a flexible polyimide film.

41. The semiconductor device of Claim 39, wherein the traces comprise copper or a copper alloy.

42. The semiconductor device of Claim 39, wherein the slot is configured to receive a bonding tool therethrough.

43. The semiconductor device of Claim 39, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on the active surface of the first semiconductor die.

44. The semiconductor device of Claim 39, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.



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45. The semiconductor device of Claim 44, wherein the adhesive element comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.

46. The semiconductor device of Claim 44, wherein the adhesive element comprises an adhesive gel or paste.

47. The semiconductor device of Claim 44, wherein the adhesive element comprises a double-sided adhesive tape.

48. The semiconductor device of Claim 44, wherein the adhesive element is disposed on the second surface of the interposer and over a portion of the traces.

49. The semiconductor of Claim 39, further comprising a soldermask disposed over the traces.

50. The semiconductor device of Claim 39, wherein the interposer comprises a pair of elongate slots along opposing sides of the interposer, and the plurality of recesses is positioned between the pair of slots.

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53. The semiconductor device of Claim 49, wherein an adhesive element is disposed over the soldermask.

54. The semiconductor device of Claim 39, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

55. The semiconductor device of Claim 39, further comprising a conductive bump disposed in the recesses of the flexible film interposer.

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56. The semiconductor device of Claim 55, further comprising a non-flexible underfill encapsulation material disposed in the recesses over the conductive bump.

57. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of at least one recess in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

58. The semiconductor device of Claim 57, wherein the slot is configured to receive a bonding tool therethrough.

59. The semiconductor device of Claim 57, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on the active surface of the first semiconductor die.

60. The semiconductor device of Claim 57, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.

61. The semiconductor device of Claim 57, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

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62. The semiconductor device of Claim 57, comprising one or more elongate slots along the peripheral edge of opposing sides of the interposer, with the recesses positioned between the pair of slots.

63. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slots, each trace extending across and exposed through the slot and the base of at least one recess, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

64. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface, a second surface; and opposing sides; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent to the slot, each recess having a base; a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slots, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base thereof; and an adhesive element disposed on the first surface, the second surface, or both surfaces of the interposer;

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the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

65. The semiconductor device of Claim 64, wherein an adhesive element is disposed in contact with the second surface of the interposer over a portion of the traces.

66. The semiconductor device of Claim 64, further comprising a soldermask layer disposed over the second surface of the interposer and the traces.

67. The semiconductor device of Claim 66, wherein an adhesive element is disposed over the soldermask layer.

68. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads, the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

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an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

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cont.

69. The stacked die assembly of Claim 68, wherein the traces of the flexible film interposer and the bond pads of the second die are bonded together by a ball bond, and the ball bond is wire bonded to the terminal pads of the interposer substrate.

70. The stacked die assembly of Claim 68, wherein the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate by a TAB bond.

71. The stacked die assembly of Claim 68, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the flexible film interposer.

72. The stacked die assembly of Claim 68, wherein the underfill material is disposed within the recesses.

73. The stacked die assembly of Claim 71, further comprising a conductive bump disposed in the recesses, and the underfill material disposed over the conductive bump.

74. The stacked die assembly of Claim 68, wherein the interposer substrate functions as a PCB substrate, or a motherboard.

75. The stacked die assembly of Claim 68, wherein the interposer substrate comprises a bismaleimide triazine resin, FR4 fiberglass laminate, FR5 laminate, or ceramic.

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76. The stacked die assembly of Claim 68, wherein the interposer substrate comprises a flexible laminated polymer or polyimide layer.

77. The stacked die assembly of Claim 68, wherein the interposer substrate further comprises external contacts for coupling the stacked die assembly to an external circuitry.

78. The stacked die assembly of Claim 77, wherein the external contacts comprise conductive solder balls.

79. The stacked die assembly of Claim 77, wherein the external contacts comprise a conductive epoxy or conductor-filled epoxy.

80. The stacked die assembly of Claim 77, wherein the external circuitry is selected from the group consisting of a motherboard of a computer, program logic controller, and a testing apparatus.

81. The stacked die assembly of Claim 68, being encapsulated to form a package.

82. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface, a second surface, and opposing sides; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon and corresponding to the plurality of spaced apart recesses in the flexible film interposer; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a

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conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

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CONY. a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon and corresponding to the slot of the flexible film interposer; the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

83. The stacked die assembly of Claim 82, being encapsulated to form a package.

84. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface, a second surface, and opposing sides; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base hereof;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon; the second semiconductor

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die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

85. The stacked die assembly of Claim 84, being encapsulated to form a package.

86. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface, a second surface, and opposing sides; a slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base thereof; and an adhesive element disposed on the first surface and the second surface of the interposer;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon; the first semiconductor die mounted onto the adhesive element on the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon along a peripheral edge; the second semiconductor die mounted onto the adhesive member on the second surface of the flexible film interposer with the bond pads exposed through the slot of the flexible film interposer;



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an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

87. The stacked die assembly of Claim 86, further comprising an adhesive member disposed between the interposer substrate and the second surface of the second semiconductor die.

88. The stacked die assembly of Claim 86, being encapsulated to form a package.

89. A semiconductor package, comprising an encapsulated stacked die assembly;  
the stacked die assembly comprising first and second semiconductor die mounted on a flexible film interposer, and the second die further mounted on an interposer substrate;  
the flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot;

the first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

the second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads; the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

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the interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

90. The package of Claim 89, wherein the interposer substrate functions as a PCB substrate, or a motherboard.
91. The package of Claim 89, wherein the interposer substrate comprises a bismaleimide triazine resin, FR4 fiberglass laminate, FR5 laminate, or ceramic.
92. The package of Claim 89, wherein the interposer substrate comprises a flexible laminated polymer or polyimide layer.
93. The package of Claim 89, wherein the interposer substrate comprises external contacts for coupling the stacked die assembly to an external circuitry.
94. The package of Claim 93, wherein the external contacts comprise conductive solder balls.
95. The package of Claim 93, wherein the external contacts comprise a conductive epoxy or conductor-filled epoxy.
96. A method of fabricating a semiconductor device, comprising the steps of:  
providing a flexible film interposer, the interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the

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interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot; and

mounting a first semiconductor die on the first surface of the flexible film interposer; the first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted on the interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

97. A method of fabricating a stacked die assembly, comprising the steps of:

providing a flexible film interposer, the interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot; and

mounting a first semiconductor die on the first surface of the flexible film interposer; the first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and the first semiconductor die mounted on the interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

mounting a second semiconductor die on an interposer substrate; the second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads; the interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed;

mounting the second semiconductor die onto the second surface of the flexible film interposer with the bond pads of the second die exposed through the slot of the interposer; and

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bonding the traces of the flexible film interposer and the bond pads of the second semiconductor die to the terminal pads of the interposer substrate.

98. The method of Claim 97, further comprising the step of forming the slot and the recesses in the flexible film interposer substrate by a process selected from the group consisting of patterning and wet etching, patterning and dry etching, mechanical drilling, punching, and laser ablation.

99. The method of Claim 97, further comprising the step of forming the conductive traces over the second surface of the interposer by a process selected from the group consisting of etching a conductive layer disposed on the second surface of the interposer, and printing the traces onto the lower surface using a conductive material.

100. The method of Claim 97, wherein the flexible film interposer further comprises an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.

101. The method of Claim 97, wherein the step of mounting the first semiconductor die on the flexible film interposer further comprises applying an adhesive element to the first surface of the flexible film interposer, to the second surface of the first semiconductor die, or both.

102. The method of Claim 101, wherein the adhesive element is selected from the group consisting of an adhesive paste, an adhesive gel, and a double sided adhesive tape.

103. The method of Claim 97, wherein the step of mounting the second semiconductor die on the flexible film interposer further comprises the step of applying an adhesive element to the second surface of the flexible film interposer, to the active surface of the second semiconductor die, or both.

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104. The method of Claim 103, wherein the adhesive element is selected from the group consisting of an adhesive paste, an adhesive gel, and a double sided adhesive tape.

105. The method of Claim 97, wherein the interposer further comprises a soldermask disposed over the second surface of the interposer and the traces.

106. The method of Claim 97, further comprising the step of applying a soldermask over the second surface of the interposer and the traces.

107. The method of Claim 104, wherein the step of mounting the second die on the flexible film further comprises the step of applying an adhesive element over the soldermask.

108. The method of Claim 97, wherein the step of bonding is by thermosonic bonding, thermocompression bonding, tape-automated bonding, or ultrasonic bonding.

109. The method of Claim 97, wherein the step of bonding comprises forming ball bonds in the slots of the flexible film interposer and over the traces and the bond pads of the second semiconductor die, and extending bonding wires from the ball bonds to the terminal pads on the interposer substrate.

110. The method of Claim 97, further comprising disposing an underfill material between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

111. The method of Claim 97, further comprising the step of encapsulating the stacked die assembly to form a semiconductor package.

112. A method of fabricating a stacked die assembly, comprising the steps of:  
fabricating an interposer from a flexible film substrate having opposing first and second surfaces, by the steps of:

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forming an elongate slot through and along a peripheral edge of the film substrate;  
forming a plurality of spaced apart recesses through the film substrate and adjacent the slot, each recess having a base; and

forming a plurality of conductive traces on the second surface of the substrate, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot; and

mounting a first semiconductive die onto the second surface of the flexible film interposer with the bond pads of the second die exposed through the slot of the interposer.

113. The method of Claim 112, further comprising, applying a soldermask over the second surface of the interposer and the traces.

114. The method of Claim 112, further comprising, prior to the step of mounting, the step of depositing an underfill material into the recesses.

115. The method of Claim 114, further comprising applying an adhesive element to the first die, the interposer, or both, such that the adhesive element is disposed between the first die and the interposer.

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116. (new) A die assembly, comprising:

a die having first and second surfaces, the first surface comprising one or more conductive connecting members; and

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

the die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess.

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117. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess; and

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer.

118. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer; and

a substrate comprising first and second surfaces, and terminal pads disposed on the first surface; the substrate mounted on the second surface of the second die with the terminal pads exposed.

## Replacement Claims

119. (new) A die assembly, comprising:

    a die having first and second surfaces, the first surface comprising one or more conductive connecting members;

    an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess; and

    means for mounting the die on the flexible film interposer; the die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess.

120. (new) The die assembly of Claim 119, wherein the mounting means is disposed on the first surface of the interposer, on the first surface of the die, or both.

121. (new) The die assembly of Claim 119, wherein the mounting means comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.

122. (new) The die assembly of Claim 119, wherein the mounting means comprises an adhesive gel or paste.

123. (new) The die assembly of Claim 119, wherein the mounting means comprises a double-sided adhesive tape.

124. (new) The die assembly of Claim 119, wherein the interposer comprises two discrete areas of recesses with an adhesive element disposed therebetween on the first surface of the interposer.

125. (new) The die assembly of Claim 119, being at least partially encapsulated to form a package.



## Replacement Claims

126. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer; and

means for mounting the dies on the flexible film interposer.

127. (new) The die assembly of Claim 126, further comprising means for bonding the traces of the interposer and the bond pads of the second die.

128. (new) The die assembly of Claim 127, wherein the bonding means comprises wire bonds or TAB bond.

129. (new) The die assembly of Claim 127, wherein the bonding means comprises a ball bond disposed in a recess in conductive contact with a trace and bond pad of the second die.

130. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

## Replacement Claims

Q3 cony. a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer;

a substrate comprising first and second surfaces, and terminal pads disposed on the first surface; the first surface of the substrate mounted on the second surface of the second die with the terminal pads exposed; and

means for connecting the assembly to an external electrical apparatus.

131. (new) The die assembly of Claim 130, wherein the assembly connecting means comprises a conductive solder, conductive epoxy, or conductor-filled epoxy, attached to the second surface of the substrate.

132. (new) The die assembly of Claim 130, wherein the assembly connecting means is in the form of balls, columns, pins, or a combination thereof, attached to the second surface of the substrate.

133. (new) The die assembly of Claim 130, further comprising means for bonding the traces of the interposer and the bond pads of the second die.

134. (new) The die assembly of Claim 133, wherein the bonding means comprises wire bonds or TAB bond.

135. (new) The die assembly of Claim 133, wherein the bonding means comprises a ball bond disposed in a recess in conductive contact with a trace and bond pad of the second die.

## Replacement Claims

136. (new) The die assembly of Claim 135, wherein the bonding means further comprises a bond wire connected to the ball bond and a terminal pad on the substrate.

137. (new) The die assembly of Claim 130, being at least partially encapsulated to form a package.

138. (new) The die assembly of Claim 130, wherein the mounting means for the second die is disposed on the second surface of the interposer and over a portion of the traces.

139. (new) A die package comprising the die assembly of Claim 116 being at least partially encapsulated.

140. (new) A die package comprising the die assembly of Claim 117 being at least partially encapsulated.

141. (new) A die package comprising the die assembly of Claim 118 being at least partially encapsulated.

142. (new) An apparatus, comprising:  
an electrical apparatus; and  
the die package of Claim 139 in electrical communication with the electrical apparatus.

143. (new) The apparatus of Claim 142, wherein the electrical apparatus comprises a testing apparatus.

144. (new) The apparatus of Claim 142, wherein the substrate is selected from the group consisting of a motherboard and a program logic controller.

## Replacement Claims

145. (new) An apparatus, comprising:

an electrical apparatus; and

the die package of Claim 140 in electrical communication with the electrical apparatus.

146. (new) An apparatus, comprising:

an electrical apparatus; and

the die package of Claim 141 in electrical communication with the electrical apparatus.

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## Blacklined Claims

### **WHAT IS CLAIMED IS:**

1. A flexible film interposer, comprising:  
a flexible substrate comprising a first surface, a second surface, and opposing sides;  
a plurality of spaced apart recesses having a base and extending through the flexible substrate for receiving conductive connecting members of a first semiconductor die therein;  
a slot formed through the substrate and disposed adjacent one of the sides of the substrate; and  
a plurality of conductive traces disposed on the second surface of the substrate, each trace extending over the slot and at least one recess, each of the recesses having a trace disposed at the base thereof.
2. The flexible film interposer of Claim 1, comprising an insulating polymeric material.
3. The flexible film interposer of Claim 2, comprising a flexible polyimide film.
4. The flexible film interposer of Claim 1, having a thickness in the range of about 12.5  $\mu\text{m}$  to about 200  $\mu\text{m}$ .
5. The flexible film interposer of Claim 1, wherein the traces comprise copper or a copper alloy.
6. The flexible film interposer of Claim 1, wherein the slot is configured to receive a bonding tool therethrough.
7. The flexible film interposer of Claim 1, wherein the slot has a width of about 50  $\mu\text{m}$  to about 2 mm.
8. The flexible film interposer of Claim 1, wherein the slot is shaped as a square, rectangle, circle, or oval.

## Blacklined Claims

9. The flexible film interposer of Claim 1, wherein the recesses comprises tapered side walls.
10. The flexible film interposer of Claim 1, wherein the recesses comprise vertically oriented sidewalls.
11. The flexible film interposer of Claim 1, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on an active surface of a semiconductor die to be attached thereto.
12. The flexible film interposer of Claim 1, wherein the recesses are shaped as a square, rectangle, circle, or oval.
13. The flexible film interposer of Claim 1, wherein the slot comprises tapered side walls.
14. The flexible film interposer of Claim 1, wherein the slot comprises vertically oriented sidewalls.
15. The flexible film interposer of Claim 1, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces.
16. The flexible film interposer of Claim 15, wherein the adhesive element comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.
17. The flexible film interposer of Claim 15, wherein the adhesive element comprises an adhesive gel or paste.

## Blacklined Claims

18. The flexible film interposer of Claim 15, wherein the adhesive element comprises a double-sided adhesive tape.
19. The flexible film interposer of Claim 15, wherein the adhesive element is disposed on the second surface of the interposer and over a portion of the traces.
20. The flexible film interposer of Claim 1, comprising two discrete areas of recesses with an adhesive element disposed therebetween on the first surface of the interposer.
21. The flexible film interposer of Claim 1, further comprising a soldermask disposed over the traces.
22. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot formed through and adjacent a side of the interposer;  
a plurality of recesses formed through the interposer and adjacent the slot, each recess sized for receiving therein a connecting member of a die in a flip chip attachment onto the interposer; and  
a plurality of conductive traces disposed on the second surface of the interposer, each trace extending over and exposed through the slot and the base of at least one of the recesses, each recess having a trace disposed at the base thereof.
23. The flexible film interposer of Claim 22, wherein the slot is sized to receive a bonding tool therethrough.
24. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot formed through and adjacent a side of the interposer;

## Blacklined Claims

a plurality of recesses formed through the interposer and adjacent the slot, each recess sized for receiving therein a connecting member of a die in a flip chip attachment onto the interposer; and

a plurality of conductive traces disposed on the second surface of the interposer, each trace extending over and exposed through the slot and one of the recesses.

25. The flexible film interposer of Claim 24, wherein an adhesive element is disposed on the first surface, the second surface, or both surfaces of the interposer.

26. The flexible film interposer of Claim 25, wherein an adhesive element is disposed on the second surface of the interposer over a portion of the traces.

27. A flexible film interposer, comprising:

a first surface and a second surface; and

an elongate slot formed through the interposer, the slot positioned along a peripheral edge of the interposer to expose bond pads on a die mounted onto the second surface of the interposer;

a plurality of recesses formed through the interposer and adjacent the slot, each recess having a base and sized for receiving therein a connecting member of a die mounted in a flip chip attachment onto the first surface of the interposer; and

a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot.

28. The flexible film interposer of Claim 27, wherein the slot is sized and configured to receive a bonding tool therethrough to contact the traces.

29. The flexible film interposer of Claim 27, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on an active surface of a semiconductor die to be attached thereto in a flip chip attachment.



## Blacklined Claims

30. The flexible film interposing of Claim 27, further comprising a soldermask disposed over the traces.

31. The flexible film interposer of Claim 30, further comprising an adhesive element disposed over the soldermask.

32. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot along a peripheral edge of the interposer;  
a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and  
a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each of the recesses having a trace disposed at the base thereof.

33. A flexible film interposer, comprising:  
a first surface and a second surface;  
an elongate slot along a peripheral edge of the interposer;  
a plurality of spaced apart recesses formed through the interposer adjacent to the slot, each recess having a base;  
a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess; and  
an adhesive element disposed on the first surface, the second surface, or both surfaces of the interposer.

## Blacklined Claims

34. The flexible film interposer of Claim 33, wherein an adhesive element is disposed on the second surface of the interposer and over a portion of the traces.

35. The flexible film interposer of Claim 33, further comprising a soldermask disposed over the traces.

36. The flexible film interposer of Claim 35, further comprising an adhesive element disposed over the soldermask.

37. A flexible film interposer, comprising:

a flexible substrate comprising a first surface, a second surface, and opposing sides;

the first surface of the substrate structured for mounting thereon a first semiconductor die having a plurality of spaced apart conductive connecting members disposed on an active surface, and the second surface structured for mounting thereon a second semiconductor die having a plurality of bond pads spaced along a periphery of the die;

the first surface of the substrate comprising a plurality of spaced apart recesses having a base and extending through the substrate for receiving the plurality of conductive connecting members of the first semiconductor die therein; and

the second surface of the substrate comprising one or more slots extending through and along a periphery of the substrate, wherein when the second semiconductor die is mounted thereon, the bonding pads are exposed through the slots.

38. The flexible film interposer of Claim 37, further comprising:

a plurality of conductive traces disposed on the second surface of the substrate, each trace extending over the slot and at least one recess, each of the recesses having a trace disposed at the base thereof.

## Blacklined Claims

39. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die when mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of at least one recess in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

40. The semiconductor device of Claim 39, wherein the flexible film interposer comprises a flexible polyimide film.

41. The semiconductor device of Claim 39, wherein the traces comprise copper or a copper alloy.

42. The semiconductor device of Claim 39, wherein the slot is configured to receive a bonding tool therethrough.

43. The semiconductor device of Claim 39, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on the active surface of the first semiconductor die.

44. The semiconductor device of Claim 39, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.

## Blacklined Claims

45. The semiconductor device of Claim 44, wherein the adhesive element comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.
46. The semiconductor device of Claim 44, wherein the adhesive element comprises an adhesive gel or paste.
47. The semiconductor device of Claim 44, wherein the adhesive element comprises a double-sided adhesive tape.
48. The semiconductor device of Claim 44, wherein the adhesive element is disposed on the second surface of the interposer and over a portion of the traces.
49. The semiconductor of Claim 39, further comprising a soldermask disposed over the traces.
50. The semiconductor device of Claim 39, wherein the interposer comprises a pair of elongate slots along opposing sides of the interposer, and the plurality of recesses is positioned between the pair of slots.
- ~~51. The semiconductor device of Claim 39, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces of the interposer.~~
- ~~52. The semiconductor device of Claim 51, wherein an adhesive element is disposed on the second surface of the interposer and over a portion of the traces.~~
53. The semiconductor device of Claim 49, wherein an adhesive element is disposed over the soldermask.

## Blacklined Claims

54. The semiconductor device of Claim 39, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

55. The semiconductor device of Claim 39, further comprising a conductive bump disposed in the recesses of the flexible film interposer.

56. The semiconductor device of Claim 55, further comprising a non-flexible underfill encapsulation material disposed in the recesses over the conductive bump.

57. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of at least one recess in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

58. The semiconductor device of Claim 57, wherein the slot is configured to receive a bonding tool therethrough.

59. The semiconductor device of Claim 57, wherein the recesses are arranged in a pattern corresponding to a bond pad configuration on the active surface of the first semiconductor die.

## Blacklined Claims

60. The semiconductor device of Claim 57, further comprising an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.

61. The semiconductor device of Claim 57, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

62. The semiconductor device of Claim 57, comprising one or more elongate slots along the peripheral edge of opposing sides of the interposer, with the recesses positioned between the pair of slots.

63. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface and a second surface; an elongate slot along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slots, each trace extending across and exposed through the slot and the base of at least one recess, each of the recesses having a trace disposed at the base thereof;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

64. A semiconductor device, comprising:

a first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and

a flexible film interposer comprising a first surface, a second surface; and opposing sides; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the

## Blacklined Claims

interposer adjacent to the slot, each recess having a base; a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slots, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base thereof; and an adhesive element disposed on the first surface, the second surface, or both surfaces of the interposer;

the first semiconductor die mounted on the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

65. The semiconductor device of Claim 64, wherein an adhesive element is disposed in contact with the second surface of the interposer over a portion of the traces.

66. The semiconductor device of Claim 64, further comprising a soldermask layer disposed over the second surface of the interposer and the traces.

67. The semiconductor device of Claim 66, wherein an adhesive element is disposed over the soldermask layer.

68. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot, each of the recesses having a trace disposed at the base thereof;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a

## Blacklined Claims

conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads, the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

69. The stacked die assembly of Claim 68, wherein the traces of the flexible film interposer and the bond pads of the second die are bonded together by a ball bond, and the ball bond is wire bonded to the terminal pads of the interposer substrate.

70. The stacked die assembly of Claim 68, wherein the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate by a TAB bond.

71. The stacked die assembly of Claim 68, further comprising an underfill encapsulation material disposed between the active surface of the first semiconductor die and the flexible film interposer.

72. The stacked die assembly of Claim 68, wherein the underfill material is disposed within the recesses.

73. The stacked die assembly of Claim 71, further comprising a conductive bump disposed in the recesses, and the underfill material disposed over the conductive bump.



## Blacklined Claims

74. The stacked die assembly of Claim 68, wherein the interposer substrate functions as a PCB substrate, or a motherboard.
75. The stacked die assembly of Claim 68, wherein the interposer substrate comprises a bismaleimide triazine resin, FR4 fiberglass laminate, FR5 laminate, or ceramic.
76. The stacked die assembly of Claim 68, wherein the interposer substrate comprises a flexible laminated polymer or polyimide layer.
77. The stacked die assembly of Claim 68, wherein the interposer substrate further comprises external contacts for coupling the stacked die assembly to an external circuitry.
78. The stacked die assembly of Claim 77, wherein the external contacts comprise conductive solder balls.
79. The stacked die assembly of Claim 77, wherein the external contacts comprise a conductive epoxy or conductor-filled epoxy.
80. The stacked die assembly of Claim 77, wherein the external circuitry is selected from the group consisting of a motherboard of a computer, program logic controller, and a testing apparatus.
81. The stacked die assembly of Claim 68, being encapsulated to form a package.
82. A stacked die assembly, comprising:  
a flexible film interposer comprising a first surface, a second surface, and opposing sides;  
an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces

## Blacklined Claims

disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon and corresponding to the plurality of spaced apart recesses in the flexible film interposer; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon and corresponding to the slot of the flexible film interposer; the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

83. The stacked die assembly of Claim 82, being encapsulated to form a package.

84. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface, a second surface, and opposing sides; an elongate slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base hereof;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon;

## Blacklined Claims

the first semiconductor die mounted onto the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon; the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

85. The stacked die assembly of Claim 84, being encapsulated to form a package.

86. A stacked die assembly, comprising:

a flexible film interposer comprising a first surface, a second surface, and opposing sides; a slot along a peripheral edge; a plurality of spaced apart recesses formed through the interposer adjacent the slot, each recess having a base; a plurality of conductive traces disposed on the second surface of the interposer in a perpendicular orientation to the slot, each trace extending across and exposed through the slot and the base of at least one recess, each recess having a trace disposed at the base thereof; and an adhesive element disposed on the first surface and the second surface of the interposer;

a first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members arranged thereon; the first semiconductor die mounted onto the adhesive element on the first surface of the flexible film interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess, and the slot of the interposer is exposed;

## Blacklined Claims

a second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads arranged thereon along a peripheral edge; the second semiconductor die mounted onto the adhesive member on the second surface of the flexible film interposer with the bond pads exposed through the slot of the flexible film interposer;

an interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

87. The stacked die assembly of Claim 86, further comprising an adhesive member disposed between the interposer substrate and the second surface of the second semiconductor die.

88. The stacked die assembly of Claim 86, being encapsulated to form a package.

89. A semiconductor package, comprising an encapsulated stacked die assembly;

the stacked die assembly comprising first and second semiconductor die mounted on a flexible film interposer, and the second die further mounted on an interposer substrate;

the flexible film interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot;

the first semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted onto the first surface of the flexible film interposer such that a

## Blacklined Claims

conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

the second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads; the second semiconductor die mounted onto the second surface of the flexible film interposer with the bond pads exposed through the slot of the interposer;

the interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed; and

the traces of the flexible film interposer and the bond pads of the second semiconductor die are bonded to the terminal pads of the interposer substrate.

90. The package of Claim 89, wherein the interposer substrate functions as a PCB substrate, or a motherboard.

91. The package of Claim 89, wherein the interposer substrate comprises a bismaleimide triazine resin, FR4 fiberglass laminate, FR5 laminate, or ceramic.

92. The package of Claim 89, wherein the interposer substrate comprises a flexible laminated polymer or polyimide layer.

93. The package of Claim 89, wherein the interposer substrate comprises external contacts for coupling the stacked die assembly to an external circuitry.

94. The package of Claim 93, wherein the external contacts comprise conductive solder balls.

95. The package of Claim 93, wherein the external contacts comprise a conductive epoxy or conductor-filled epoxy.

## Blacklined Claims

96. A method of fabricating a semiconductor device, comprising the steps of:

providing a flexible film interposer, the interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot; and

mounting a first semiconductor die on the first surface of the flexible film interposer; the first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; the first semiconductor die mounted on the interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess.

97. A method of fabricating a stacked die assembly, comprising the steps of:

providing a flexible film interposer, the interposer comprising a first surface and a second surface; an elongate slot formed through and along a peripheral edge of the interposer to expose bond pads on a second semiconductor die mounted onto the second surface of the interposer; a plurality of spaced apart recesses formed through the interposer and adjacent the slot, each recess having a base; and a plurality of conductive traces disposed on the second surface of the interposer, each trace extending across and exposed through the slot and the base of one or more adjacent recesses in a perpendicular orientation to the slot; and

mounting a first semiconductor die on the first surface of the flexible film interposer; the first semiconductor die having a first active surface and a second surface, the active surface comprising a plurality of spaced apart conductive connecting members; and the first semiconductor die mounted on the interposer such that a conductive connecting member of the die is received in a recess of the interposer in conductive contact with the trace at the base of the recess;

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mounting a second semiconductor die on an interposer substrate; the second semiconductor die comprising a first active surface and a second surface, the active surface comprising a plurality of bond pads; the interposer substrate comprising a first surface and a second surface, and terminal pads disposed on the first surface; the interposer substrate mounted onto the second surface of the second semiconductor die with the terminal pads exposed;

mounting the second semiconductor die onto the second surface of the flexible film interposer with the bond pads of the second die exposed through the slot of the interposer; and

bonding the traces of the flexible film interposer and the bond pads of the second semiconductor die to the terminal pads of the interposer substrate.

98. The method of Claim 97, further comprising the step of forming the slot and the recesses in the flexible film interposer substrate by a process selected from the group consisting of patterning and wet etching, patterning and dry etching, mechanical drilling, punching, and laser ablation.

99. The method of Claim 97, further comprising the step of forming the conductive traces over the second surface of the interposer by a process selected from the group consisting of etching a conductive layer disposed on the second surface of the interposer, and printing the traces onto the lower surface using a conductive material.

100. The method of Claim 97, wherein the flexible film interposer further comprises an adhesive element disposed on the first surface, the second surface, or both surfaces of the flexible film interposer.

101. The method of Claim 97, wherein the step of mounting the first semiconductor die on the flexible film interposer further comprises applying an adhesive element to the first surface of the flexible film interposer, to the second surface of the first semiconductor die, or both.

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102. The method of Claim 101, wherein the adhesive element is selected from the group consisting of an adhesive paste, an adhesive gel, and a double sided adhesive tape.

103. The method of Claim 97, wherein the step of mounting the second semiconductor die on the flexible film interposer further comprises the step of applying an adhesive element to the second surface of the flexible film interposer, to the active surface of the second semiconductor die, or both.

104. The method of Claim 103, wherein the adhesive element is selected from the group consisting of an adhesive paste, an adhesive gel, and a double sided adhesive tape.

105. The method of Claim 97, wherein the interposer further comprises a soldermask disposed over the second surface of the interposer and the traces.

106. The method of Claim 97, further comprising the step of applying a soldermask over the second surface of the interposer and the traces.

107. The method of Claim 104, wherein the step of mounting the second die on the flexible film further comprises the step of applying an adhesive element over the soldermask.

108. The method of Claim 97, wherein the step of bonding is by thermosonic bonding, thermocompression bonding, tape-automated bonding, or ultrasonic bonding.

109. The method of Claim 97, wherein the step of bonding comprises forming ball bonds in the slots of the flexible film interposer and over the traces and the bond pads of the second semiconductor die, and extending bonding wires from the ball bonds to the terminal pads on the interposer substrate.



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110. The method of Claim 97, further comprising disposing an underfill material between the active surface of the first semiconductor die and the first surface of the flexible film interposer.

111. The method of Claim 97, further comprising the step of encapsulating the stacked die assembly to form a semiconductor package.

112. A method of fabricating a stacked die assembly, comprising the steps of:

fabricating an interposer from a flexible film substrate having opposing first and second surfaces, by the steps of:

forming an elongate slot through and along a peripheral edge of the film substrate;

forming a plurality of spaced apart recesses through the film substrate and adjacent the slot, each recess having a base; and

forming a plurality of conductive traces on the second surface of the substrate, each trace extending across and exposed through the slot and the base of one or more recesses in a perpendicular orientation to the slot; and

mounting a first semiconductive die onto the second surface of the flexible film interposer with the bond pads of the second die exposed through the slot of the interposer.

113. The method of Claim 112, further comprising, applying a soldermask over the second surface of the interposer and the traces.

114. The method of Claim 112, further comprising, prior to the step of mounting, the step of depositing an underfill material into the recesses.

115. The method of Claim 114, further comprising applying an adhesive element to the first die, the interposer, or both, such that the adhesive element is disposed between the first die and the interposer.

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116. (new) A die assembly, comprising:

a die having first and second surfaces, the first surface comprising one or more conductive connecting members; and

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

the die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess.

117. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess; and

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer.

118. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

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a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer; and

a substrate comprising first and second surfaces, and terminal pads disposed on the first surface; the substrate mounted on the second surface of the second die with the terminal pads exposed.

119. (new) A die assembly, comprising:

a die having first and second surfaces, the first surface comprising one or more conductive connecting members;

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess; and

means for mounting the die on the flexible film interposer; the die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess.

120. (new) The die assembly of Claim 119, wherein the mounting means is disposed on the first surface of the interposer, on the first surface of the die, or both.

121. (new) The die assembly of Claim 119, wherein the mounting means comprises a contact adhesive, thermoplastic adhesive, or a thermosetting adhesive.

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122. (new) The die assembly of Claim 119, wherein the mounting means comprises an adhesive gel or paste.

123. (new) The die assembly of Claim 119, wherein the mounting means comprises a double-sided adhesive tape.

124. (new) The die assembly of Claim 119, wherein the interposer comprises two discrete areas of recesses with an adhesive element disposed therebetween on the first surface of the interposer.

125. (new) The die assembly of Claim 119, being at least partially encapsulated to form a package.

126. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer; and

means for mounting the dies on the flexible film interposer.

127. (new) The die assembly of Claim 126, further comprising means for bonding the traces of the interposer and the bond pads of the second die.

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128. (new) The die assembly of Claim 127, wherein the bonding means comprises wire bonds or TAB bond.

129. (new) The die assembly of Claim 127, wherein the bonding means comprises a ball bond disposed in a recess in conductive contact with a trace and bond pad of the second die.

130. (new) A die assembly, comprising:

an interposer comprising first and second surfaces; an elongate slot formed through and along a peripheral edge of the interposer; one or more recesses disposed through the interposer adjacent the slot; and one or more conductive traces disposed on the second surface of the interposer and extending across and exposed through the slot and at least one recess;

a first die comprising first and second surfaces, the first surface comprising one or more conductive connecting members, the first die mounted on the first surface of the interposer with each of the one or more conductive connecting members disposed in a recess in conductive contact with the trace extending across the recess;

a second die comprising first and second surfaces, the first surface comprising one or more bond pads, the second die mounted on the second surface of the interposer with each of the bond pads exposed through the slot of the interposer;

a substrate comprising first and second surfaces, and terminal pads disposed on the first surface; the first surface of the substrate mounted on the second surface of the second die with the terminal pads exposed; and

means for connecting the assembly to an external electrical apparatus.

131. (new) The die assembly of Claim 130, wherein the assembly connecting means comprises a conductive solder, conductive epoxy, or conductor-filled epoxy, attached to the second surface of the substrate.

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132. (new) The die assembly of Claim 130, wherein the assembly connecting means is in the form of balls, columns, pins, or a combination thereof, attached to the second surface of the substrate.

133. (new) The die assembly of Claim 130, further comprising means for bonding the traces of the interposer and the bond pads of the second die.

134. (new) The die assembly of Claim 133, wherein the bonding means comprises wire bonds or TAB bond.

135. (new) The die assembly of Claim 133, wherein the bonding means comprises a ball bond disposed in a recess in conductive contact with a trace and bond pad of the second die.

136. (new) The die assembly of Claim 135, wherein the bonding means further comprises a bond wire connected to the ball bond and a terminal pad on the substrate.

137. (new) The die assembly of Claim 130, being at least partially encapsulated to form a package.

138. (new) The die assembly of Claim 130, wherein the mounting means for the second die is disposed on the second surface of the interposer and over a portion of the traces.

139. (new) A die package comprising the die assembly of Claim 116 being at least partially encapsulated.

140. (new) A die package comprising the die assembly of Claim 117 being at least partially encapsulated.

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141. (new) A die package comprising the die assembly of Claim 118 being at least partially encapsulated.

142. (new) An apparatus, comprising:

an electrical apparatus; and

the die package of Claim 139 in electrical communication with the electrical apparatus.

143. (new) The apparatus of Claim 142, wherein the electrical apparatus comprises a testing apparatus.

144. (new) The apparatus of Claim 142, wherein the substrate is selected from the group consisting of a motherboard and a program logic controller.

145. (new) An apparatus, comprising:

an electrical apparatus; and

the die package of Claim 140 in electrical communication with the electrical apparatus.

146. (new) An apparatus, comprising:

an electrical apparatus; and

the die package of Claim 141 in electrical communication with the electrical apparatus.